



Saturn — From the Outside In

Questions, Answers, and Cool Things to Think About

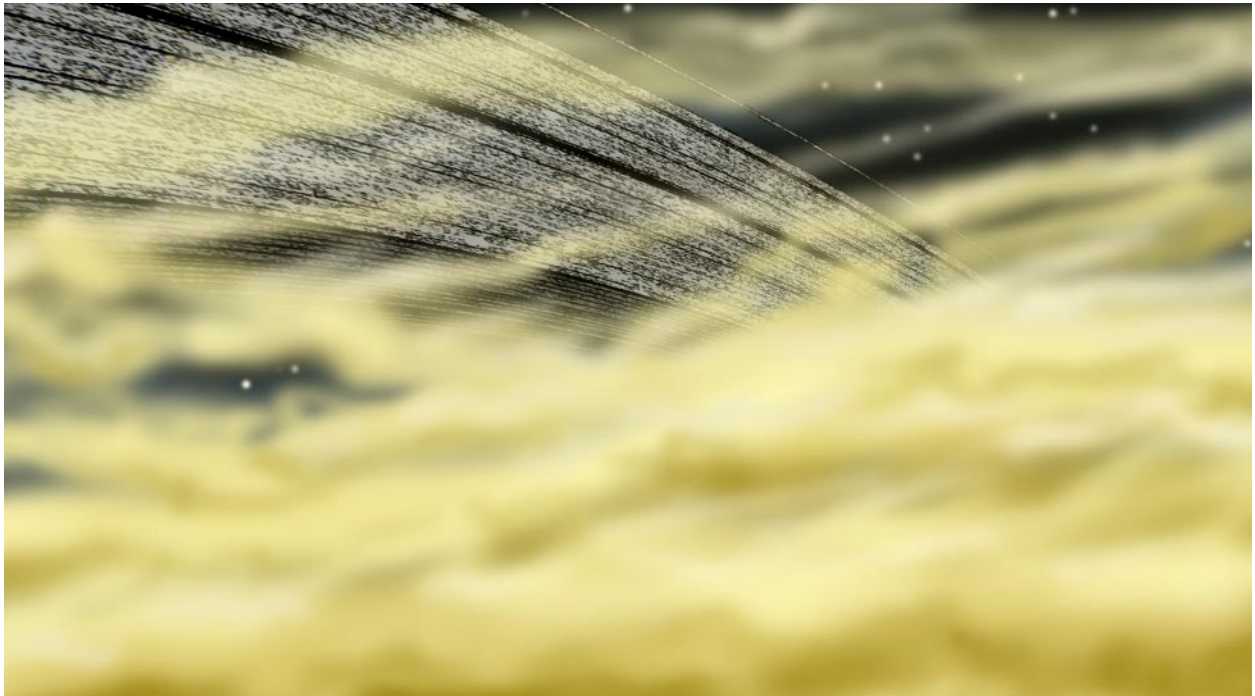


Discovering Saturn: The Real Lord of the Rings

Although no one has ever traveled from Saturn's atmosphere to its core, scientists do have an understanding of what's there, based on their knowledge of natural forces, chemistry, and mathematical models. If you were able to go deep into Saturn, here's what you might find along your journey.

First, you would enter Saturn's upper atmosphere, which has super-fast winds. In fact, winds near Saturn's equator (the fat middle) can reach speeds of 1,100 miles per hour. That is almost four times as fast as the fastest hurricane winds on Earth! These winds get their energy from heat rising from Saturn's

interior. As gases in Saturn's interior warm up, they rise until they reach a level where the temperature is cold enough to freeze them into particles of solid ice. Icy ammonia forms the outermost layer of clouds, which look yellow because ammonia reflects the sunlight. Other chemicals, trapped in the ammonia ice particles, add shades of brown and other colors to the clouds. Methane and water freeze at higher temperatures, so they turn to ice farther down, below the ammonia clouds. Hydrogen and helium rise even higher than the ammonia without freezing at all. They remain gases above the cloud tops.



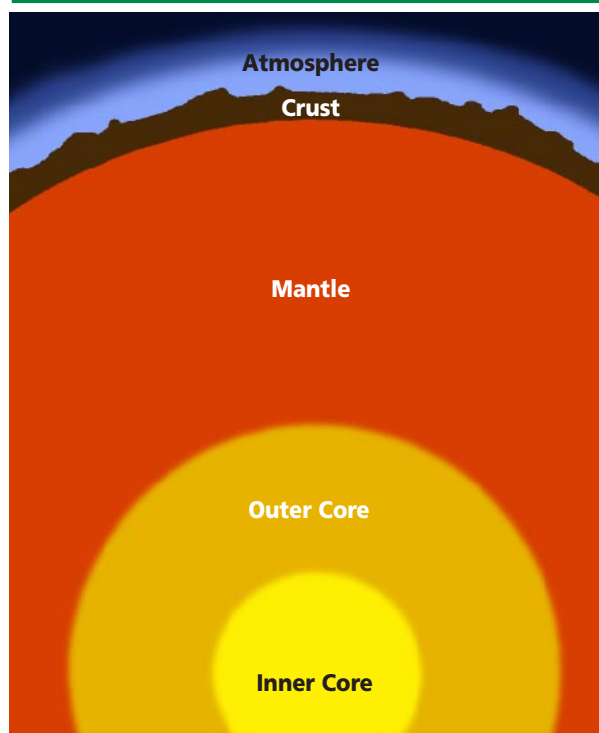
Fierce winds blow clouds of icy ammonia across Saturn's upper atmosphere.

Warm gases are continually rising in Saturn's atmosphere, while icy particles are continually falling back down to the lower depths, where they warm up, turn to gas and rise again. This cycle is called "convection" (kon-VEK-shun). You can see the same kind of thing happen if you watch a big pot of soup boiling on your stove!

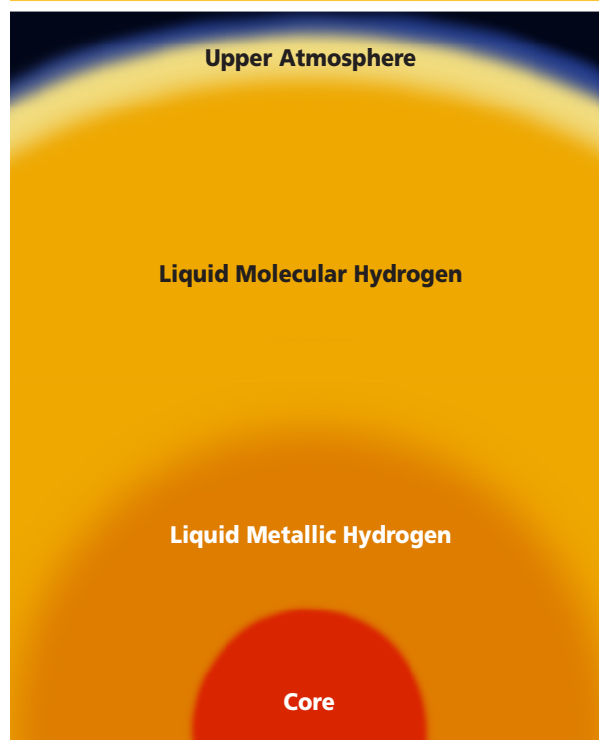
From far away, Saturn may look like a gigantic ringed version of the rocky planets in the inner solar system. However, it is really quite different. Unlike planet Earth, where there is a sudden change from the gases in the atmosphere to the solid crust (land) or liquid (oceans), the layers within Saturn and the other giant planets change from one form to another gradually.

Saturn is made up mainly of hydrogen and helium, in both gas and liquid forms. You couldn't stand on Saturn, because there's no solid surface to stand on. If you tried to "land" on Saturn, you'd sink thousands of miles to depths where the heat and pressure are so high that not even the sturdiest submarine could survive!

Earth's Layers



Saturn's Layers



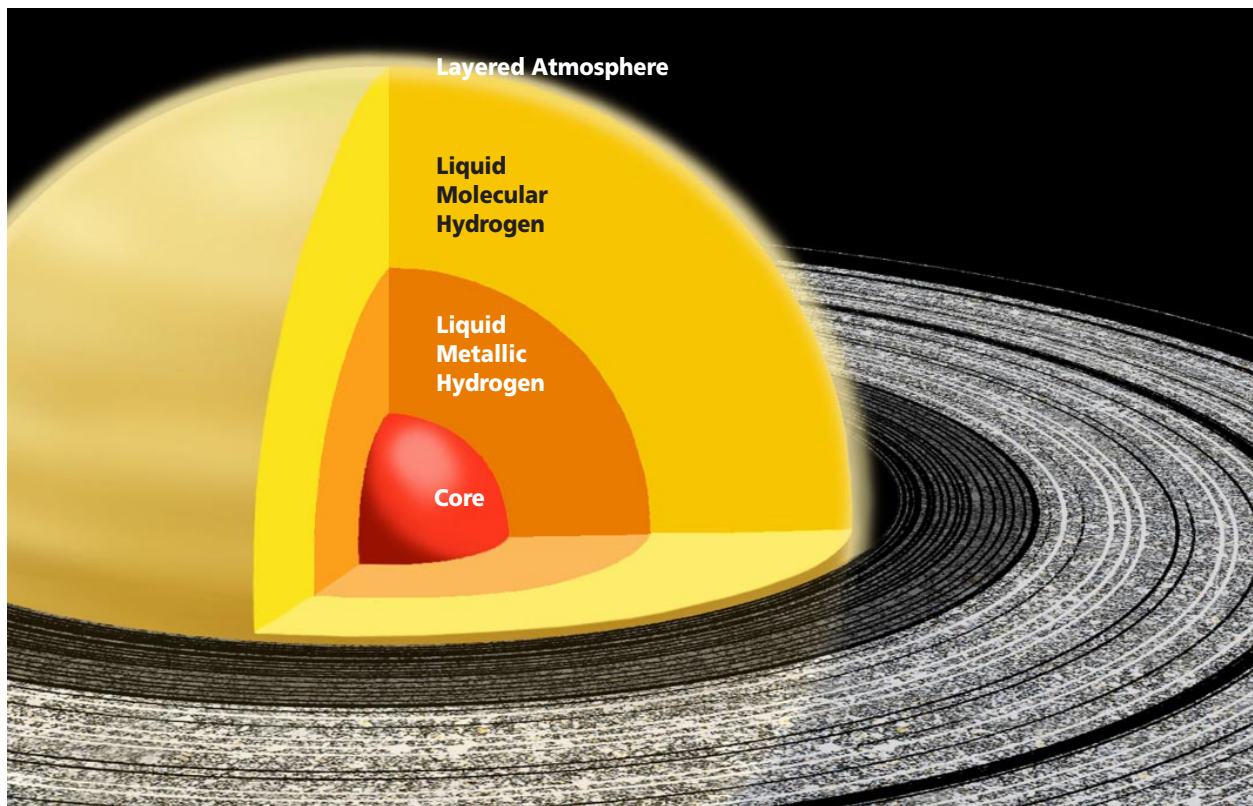
Comparing Earth's Layers to Saturn's Layers

The liquid sections of Saturn form the largest portions of the planet, and are very deep. The first liquid layer inside Saturn, immediately under the atmosphere, is the liquid hydrogen layer. Under the liquid hydrogen layer is a liquid metallic hydrogen layer.

You may be wondering how a gas like hydrogen can also be a liquid. The answer is that most substances can be solid, liquid, or gas, depending on their temperature and pressure. For example, water is liquid at room tempera-

ture, but freezes into a solid when it's very cold and boils into water vapor (a gas) when it's very hot. Also, liquid water can boil into vapor at a lower temperature if you carry it up to a very high mountain, where the pressure in the atmosphere is less than it is at sea level. Bring the water vapor back down to sea level, where the pressure in the atmosphere is higher, and it turns back into a liquid.

Deep within Saturn, the pressure is so enormous that it turns the hydrogen



Inside Saturn

gas into a liquid, even though the temperature is also very high. Still deeper, where the pressure is even greater, the liquid hydrogen acts like a metal and can conduct electricity.

Finally, at Saturn's center is a molten rocky metallic core. Saturn's interior is hot! At the core, the temperature is at least 15,000 degrees Fahrenheit. That's hotter than the surface of the Sun!